

What is claimed is:

1. An image processing method wherein an original image is quantized into n -levels and outputted, said method comprising the steps of:

5 ranking the respective pixels in an area according to the value of the image data of said pixels, said area being a specific area (hereinafter referred to as scanning window) in an original image data containing an object pixel, pixels around said object pixels and input pixels and said ranking effected in said scanning window,

10 level division to extract the pixels belonging to the same division levels as at the time when the respective re-allocated pixels and said inputted image data are divided in $(n - 1)$ levels in said scanning window,

calculating, by levels, an allocation number or quotient and residual by working out the sum of re-allocation values or the sum of image data of said respective level divided pixels, said quotient and residual obtained when said re-allocation value sum is divided by the specific value,

15 re-allocating, by levels, said specific values and said residuals in said allocation number according to said rank order, and

20 multi-leveling and outputting the sum of re-allocation values at the position of said object pixel.

2. The image processing method as defined in claim 1 wherein in said level division, said inputted image data is divided into $(n - 1)$ levels and placed in the scanning windows for respective levels, in addition to the respective pixels already re-allocated in the scanning windows for respective levels.

3. The image processing method as defined in claim 1 wherein in said level division, after said input image data are put in the sum image data, by levels, of the respective pixels re-allocated in said scanning window, the data in the scanning window are divided in $(n - 1)$ levels.

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4. The image processing method as defined in claim 3 wherein a level synthesis step is interposed before said level division, said level synthesis step being for adding up the output of said re-allocation by levels by pixels on the respective levels to acquire the sums thereof by pixels.

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5. The image processing method as defined in claim 1 wherein, based on the input image data, level for the $(n-1)$ -level-divided image data of original image belonging to the scanning window is decided on, the input image data as well as the respective pixels for said level, which are already re-allocated in said scanning windows for the respective levels, are extracted.

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6. The image processing method as defined in any of claims 2, 3 and 5 wherein in said level division, image data belonging to the range of the object division level is given a value obtained by subtracting the maximum value on the level immediately below from said image data; image data not smaller than the maximum value of the object division level is given the maximum value of the object division level; and image data not higher than the minimum value of the object division level is given "0".

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7. The image processing method as defined in any of claims 2, 3

and 5 wherein in said level division, image data belonging to the range of the division level of the processing object is left as it is, and image data outside the range of the division level of the processing object is given "0".

5 8. The image processing method as defined in claim 2 or 5 wherein after calculating the sum of data at the object pixels of the respective levels, said multi-leveling step multi-valuates said sum.

10 9. The image processing method as defined in claim 4 wherein said multi-leveling step multi-valuates the sum of image data at the object pixels of the respective levels obtained from said level synthesis step.

15 10. The image processing method as defined in claim 1 wherein said specific number n is changed at will.

20 11. The image processing method as defined in claim 1 wherein said specific value is the range between the divided levels.

25 12. The image processing method as defined in claim 1 wherein said re-allocation step adds an error to the re-allocation value sum of one of the division levels in the subsequent processing, said error obtained when the re-allocation value at the position of said object pixel and the re-allocation value at said object pixel are quantized into n-levels.

 13. The image processing method as defined in claim 12 wherein said re-allocation value sum of one of the division levels is the sum of the re-allocation values of the divided levels of the pixel having the maximum level in said scanning window.

14. An image processing method wherein an original image is quantized into n -levels and outputted, said method provided with switchover arrangements to choose between two different re-allocation ways of getting re-allocation values and a multi-leveling step of multi-leveling the output of said switchover arrangements, and one of said two different re-allocation ways comprising the steps of:

ranking the respective pixels in a scanning window of an original image; said ranking effected in said scanning window according to the value of the image data of said pixels, and said scanning window containing an object pixel, pixels around said object pixels and input pixels,

level division to extract the pixels belonging to the same division levels as at the time when the respective pixels already re-allocated in said scanning window in the preceding processing and said input image data are divided in $(n - 1)$ levels,

calculating, by levels, the allocation number or quotient and residual by working out the sum of re-allocation values or the sum of image data of said respective level divided pixels, said quotient and residual obtained when said re-allocation value sum is divided by a specific value,

re-allocating, by levels, said specific values and said residuals in said allocation number according to said rank order, and

level synthesis to work out the sum of the respective pixels re-allocated by levels in said processing, and
the other of said two re-allocation ways comprising the steps of:

said ranking that is provided in the first re-allocation way,

calculating the allocation number or quotient and residual by

working out the sum of re-allocation values or the sum of image data of the respective pixels already re-allocated in said scanning window in the previous processing and said input pixel, said quotient and residual obtained when said re-allocation value sum is divided by a specific value,
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re-allocating said specific values and said residuals in the allocation number according to said rank order.

15. The image processing method as defined in claim 1 or claim 14,
10 said method comprising the steps of:

ranking correction to find neighborhood correction quantity proportional to the mean value of the ranking correction quantity of pixels in a specific number in said neighborhood on the basis of the ranking correction quantity of pixels in the specific number in the neighborhood of
15 the pixels at the position of the object pixel and to generate a new ranking correction quantity to which are added the difference between the mean value and the multi-leveled data of the object pixel obtained from said multi-leveling step and said mean value, and

ranking image data of the object pixel after correcting said image
20 data of the object image on the basis of said neighborhood correction quantity, said image data of the object image contained in the scanning window of the original image

16. The image processing method as defined in claim 15 wherein
25 said neighborhood correction quantity is controlled by external signals.

17. An image processing apparatus wherein an original image is quantized into n-levels and outputted, said apparatus comprising:

ranking means for ranking the respective pixels in said scanning window of an original image according to the value of the image data of said pixels, said scanning window containing an object pixel, pixels around said object pixels and inputted pixels, and ranking effected in said scanning window,

level division means for extracting the pixels belonging to the same division levels as at the time when the respective pixels already re-allocated in said scanning window in the preceding processing and said input image data are divided in $(n - 1)$ levels,

means for calculation of allocation values by levels for calculating the sum of re-allocation values or the sum of image data of said respective level divided pixels to acquire the allocation number or quotient and residual obtained when said re-allocation value sum is divided by a specific value,

means for re-allocation by levels for re-allocating, by levels, said specific values and said residuals in said allocation number according to said rank order, and

multi-leveling means for n-leveling and outputting the sum of re-allocation values at the position of said object pixel.

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18. The image processing apparatus as defined in claim 17 wherein said level division means divides said input image data in $(n - 1)$ levels and places the values obtained in the scanning windows for the respective levels, in addition to the respective pixels already re-allocated in the scanning windows for the respective levels.

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19. The image processing apparatus as defined in claim 17 wherein after putting said input image data in the image data of the sum, by levels,

of the respective pixels re-allocated in said scanning window, said level division means divides the data in the scanning window in $(n - 1)$ levels.

20. The image processing apparatus as defined in claim 19 wherein
5 level synthesis means is interposed before level division means, said level synthesis means being for adding up the outputs of said storage means for re-allocation by levels by pixels on the respective levels and acquiring the sum thereof.

10 21. The image processing apparatus as defined in claim 17 wherein,
based on the input image data, level for the $(n-1)$ -level-divided image data of original image belonging to the scanning window is decided on, the input image data as well s the respective pixels for said level, which are already re-allocated in said scanning windows for the respective levels,
15 are extracted.

22. The image processing apparatus as defined in any of claims 18,
19 and 21 wherein said level division means gives a value obtained by subtracting the maximum value of the level immediately below from said
20 image data to the image data belonging to the range of the division level, the maximum value of the object division level to the image data not smaller than the maximum value of the object division level and "0" to the image data not larger than the minimum value of the object division level.

25 23. The image processing apparatus as defined in any of claims 18,
19 and 21 wherein said level division means leaves the image data belonging to the range of the object division level as they are and gives "0" to the image data outside the range of the object division level.

24. The image processing apparatus as defined in claim 18 or 21 wherein said multi-leveling means calculates the sum of data for the object pixels of the respective levels and multi-valuates said sum.

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25. The image processing apparatus as defined in claim 20 wherein said multi-leveling means acquires from said level synthesis means the sum of data for the object pixels of the respective levels and multi-valuates said sum.

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26. The image processing apparatus as defined in claim 17, said apparatus comprising level control means which permits setting said specific number n according to the directions of the user or a higher level direction means, and

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wherein said level division means, means for calculation of re-allocation values and re-allocation means perform specific processings on the basis of specific number n.

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27. The image processing apparatus as defined in claim 17 wherein said specific value is the range between the divided levels.

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28. The image processing apparatus as defined in claim 17 wherein said re-allocation means adds an error to the sum of re-allocation values of one of the division levels in the subsequent processing, said error obtained by multi-leveling means when the re-allocation value at the position of said object pixel and the re-allocation value at said object pixel are n-multi-leveled.

29. The image processing apparatus as defined in claim 28 wherein one of said division levels is the maximum level in said scanning window.

30. An image processing apparatus wherein an original image is
5 quantized into n -levels and outputted, said apparatus provided with switchover means for switching re-allocation values outputted from two different re-allocation means and multi-leveling means for multi-leveling the outputs of said switchover means, one of said re-allocation means comprising:

10 ranking means for ranking the respective pixels in said scanning window of the original image, said ranking effected in said scanning window according to the value of the image data of said pixels, and said scanning window containing an object pixel, pixels around said object pixels and input pixels,

15 level division means for extracting the pixels belonging to the same division levels as levels at the time when the respective pixels already re-allocated in said scanning window in the preceding processing and said input image data are divided in $(n - 1)$ levels,

20 means for calculation of allocation values by levels for calculating, by levels, the sum of re-allocation values or the sum of image data of said respective level divided pixels and acquiring the allocation number or quotient and residual obtained when said re-allocation value sum is divided by a specific value,

25 means for re-allocation by levels for re-allocating, by levels, said specific values and said residuals in said allocation number according to said rank order, and

level synthesis means for acquiring the sum of the respective pixels re-allocated by levels in said processing, and

the other of said two re-allocation means comprising:

said ranking means provided in the first re-allocation means,

means for calculation of re-allocation values for calculating the
sum of re-allocation values or the sum of image data of the respective
5 pixels re-allocated in said scanning window in the preceding processing
and of said input pixels and acquiring the allocation number or quotient
and residual obtained when said re-allocation value sum is divided by a
specific value, and

re-allocation means for re-allocating said specific values and said
10 residuals in the allocation number according to said rank order.

31. The image processing apparatus as defined in claim 17 or 30,
said apparatus comprising:

ranking correction means for finding a neighborhood correction
15 quantity proportional to the mean value of the ranking correction quantity
of pixels in a specific number in the neighborhood of the pixels at the
position of the object pixel on the basis of the ranking correction quantity
of pixels in the specific number in said neighborhood and generating a new
ranking correction quantity to which are added the difference between a
20 mean value and the multi-leveled data of the object pixel outputted from
said multi-leveling means, said mean value being the mean value of
ranking correction quantities of pixels in a specific number in said
neighborhood, and

ranking means for ranking object pixels after correcting image
25 data of the object pixels on the basis of said neighborhood correction
quantity, said image data of the object image contained in the scanning
window of the original image.

1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	24
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